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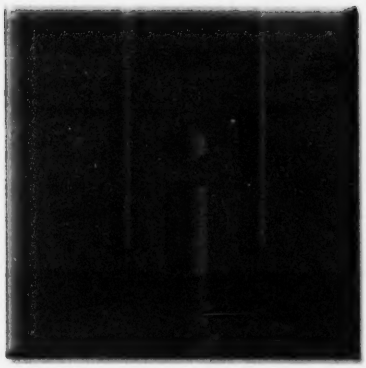
Research Paper

The Canadian Productivity Review

Productivity Performance in Canada, 1961 to 2008: An Update on Long-term Trends



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Statistics Canada
Economic Analysis Division

Productivity Performance in Canada, 1961 to 2008: An Update on Long-term Trends

John Baldwin and Wulong Gu

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Abstract

Baldwin and Gu (2008) provide an overview of the productivity program at Statistics Canada and a brief description of Canada's productivity performance. This paper provides an update of Canada's productivity performance in more recent years and analyses the sources of weak productivity performance in Canada since 2000.

Keywords: productivity growth, Canada–United States productivity levels, terms of trade effects

Executive summary

This paper summarizes Canada's long-run productivity performance, with an emphasis on how the post-2000 experience compares to that of previous decades. In doing so, it asks a set of questions.

1) Has the contribution of the growth in labour productivity to the growth in gross domestic product changed?

Over the period 2000-2008, business sector GDP grew at 2.2% per year, less than the 3.0% of the period 1988-2000. The contribution of the growth in labour productivity to the growth in GDP declined after 2000 while the contribution of the growth in hours worked to the growth in GDP increased. The contribution of labour productivity accounted for 34% of GDP growth after 2000 compared to the 56% contribution in the previous decade. Labour productivity grew at 0.7% per year versus 1.7% in the previous period. In contrast, hours worked increased to 1.4%, slightly more than the 1.3% previously.

2) How has labour productivity growth compared to the growth in real labour income?

Over the entire 1961-2008 period, average annual real labour compensation increased by 1.8%, while labour productivity increased by 2.0%. The growth in average annual real hourly labour compensation over the 2000-2008 period (0.9%) tracked labour productivity (0.7%) closely, while it was slightly below in the 1990s.

3) Where has the growth in labour productivity come from—increases in capital intensity, increases in the composition (quality) of the workforce, or increases in multifactor productivity?

Over the period from 1988 to 2000, increases in capital intensity contributed 1.0 percentage points of the 1.7 percentage points annual increase in labour productivity; higher labour skills, 0.4 percentage points; and multifactor productivity, 0.3 percentage points. Over the post-2000 period, growth in capital intensity contributed 1.1 percentage points, labour composition some 0.3 percentage points, but MFP turned negative. The slowdown in labour productivity after 2000 was almost entirely accounted for by the factors that determine multifactor growth—technology, innovation, firm organization, scale and capacity utilization effects.

4) Which industries accounted for the slowdown in productivity growth between the 1990s and the post-2000 periods?

The post-2000 slowdown in aggregate business sector labour productivity growth was mostly accounted for by the slowdown in productivity growth of two major industry groups: Mining, Oil and Gas Extraction; and Manufacturing. The Finance, Insurance and Real Estate (FIRE) industry also made a small contribution to lower productivity growth after 2000.

Across all industries, the slowdown in productivity growth was positively correlated to output growth. Where output growth slowed the most, so did productivity growth.

5) How has Canadian productivity growth compared with the United States?

Labour productivity grew more quickly in Canada from 1961 to 1985, then less quickly until 1990, by which time the two countries had returned essentially to their 1961 relative levels. The relative growth rates were about the same throughout the 1990s. Since 2000, Canada has fallen considerably behind.

6) What accounts for the differences in the paths of labour productivity growth– differences in the growth of capital intensity, differences in skill upgrading (labour composition) or differences in MFP?

The small labour productivity growth difference in favour of the United States over the period from 1961 to 2008 owes much to higher MFP growth in the United States, which persisted throughout the period. Over the period from 1961 to 2008, annual labour productivity growth in the Canadian business sector was slightly, but not significantly, lower (0.3 percentage points) than in the U.S. business sector. The annual growth of MFP in Canada was 0.9 percentage points lower than in the United States.

In contrast, there was no continuous gap in the growth of capital intensity between Canada and the United States over the period from 1961 to 1996. Indeed, early in the period, the growth of the contribution of capital deepening to business sector productivity growth was higher in Canada than in the United States, and this generated higher labour productivity growth. Starting in the late 1970s and early 1980s, the Canada/United States capital intensity growth difference became smaller only to see the two countries follow much the same growth path in this component over the late 1980s. As in the previous period, this change in capital intensity was primarily responsible for the change experienced in relative labour productivity in the two countries during this period. A significant gap in the growth in capital intensity opened up in Canada after 1996, which was reversed in recent years.

The contribution of labour composition to business sector labour productivity growth was higher in Canada than in the United States over much of the period from 1961 to 2008—although the differential narrowed later in the period. From 1961 to 2008, the shift towards more educated and more experienced workers occurred more rapidly in Canada than in the United States, which raised labour productivity growth by 0.2 percentage points per year in the Canadian business sector relative to that of the U.S. business sector.

Over the 2000-2008 period, labour productivity growth in the Canadian business sector was much lower than that in the U.S. business sector. The Canada-U.S. labour productivity growth gap was 1.9 percentage points per year.

The chief contributor to the increase in the Canada-U.S. labour productivity growth gap in the period 2000-2008 was the slower growth of MFP in Canada. The effect of changes in capital intensity and labour composition was similar between the two countries.

7) Which industries accounted for the opening of the Canada/U.S labour productivity growth gap after 2000?

Over the post-2000 period, Canada had much slower labour productivity growth than the United States in three sectors: Manufacturing, Information and Culture and the Finance, Insurance and Real Estate sector.

8) What is the approximate level of Canada's productivity compared to the United States?

Canada's labour productivity level in the business sector has been lower than in the United States since 1961. The difference was relatively small in the mid-1980s when Canada's labour productivity was 10% below the U.S. level. After the mid-1980s, Canada's labour productivity declined. By 2008, Canada's labour productivity was only three-quarters of the U.S. level.

9) What is the source of differences in Canada/U.S. levels of GDP per capita–labour productivity differences or differences in hours worked?

In 2008, the Canada/U.S. output gap in favour of the United States was 16% in terms of GDP per capita. The relatively lower level of Canadian labour productivity accounted for 14 percentage points of this output gap. The lower level of hours worked per capita in Canada than in the United States accounted for the remaining 2 percentage points of the output gap.

This is a substantial change from the 1990s when the majority of the difference came from hours worked. GDP per capita in Canada has remained virtually unchanged compared to the United States after 2000, despite the fall in relative labour productivity. This is a result of the increase in labour utilization (hours worked per capita) in Canada relative to the United States that offset the decline in relative labour productivity. The post-2000 period was marked by a much more robust labour market in Canada than in the United States.

10) Have other measures of well-being fallen relative to the United States starting in 2000?

Evaluating an economy's performance usually is done using a volume measure of GDP, which represents the constant dollar income (labour income plus profits) that an economy generates through domestic production, with the volume or constant dollar indices being calculated from the prices of domestic goods and services produced. When the concept of real income is widened to include changes in the purchasing power of earned income that is generated by the changing relative prices of exports and imports, the relevant measure is real Gross National Income (GNI). Changes in purchasing power come from changes in relative prices of exports and imports—one of which is the terms of trade.

Since 2000, prices of Canadian exports have increased markedly relative to the price of imports. Canadian receipts of income from abroad have also increased relative to payments abroad. These two events led to a sharp increase in measures of real income growth that take into account changes in the terms of trade and income from foreign investments. This has implications for Canada–United States comparisons. Canada had a strong terms-of-trade improvement from 2002 to 2008, due to rising commodity prices, an appreciating currency and falling world prices for manufactured goods that contributed greatly to real income growth. The U.S. measures of real income were much less affected by changes in their terms of trade.

As a result, comparisons of the relative per capita performance of the two countries hinges on whether or not the terms of trade and international income flows are incorporated into the analysis. If the terms of trade are excluded and relative real GDP per capita growth (or relative productivity growth) is the focus, Canada appears to have performed worse than the United States from 2002 to 2006, when U.S. real GDP per capita grew 9.3% while Canadian GDP per capita rose 7.0%. Once changes in the terms of trade and international investment income are taken into account, real income per capita in the United States increased by 8.6%, which is similar to its GDP per capita growth. However, the adjusted Canadian measure of real income per capita growth rose 15.6%, more than twice the per capita real GDP growth in Canada, and nearly double the U.S. rate.

1 Introduction

The productivity program at Statistics Canada produces a range of summary statistics on productivity and an industry database containing outputs and inputs. This product is accompanied by analysis that provides the public with an understanding of the portfolio of products and background issues.

Baldwin and Gu (2008) provide an overview of the productivity program at Statistics Canada and a brief description of Canada's productivity performance using data produced by the productivity program of Statistics Canada. This paper provides an update of Canada's productivity performance in more recent years and analyses the sources of weak productivity performance in Canada since 2000.[1]

1.1 What is productivity?

Productivity measures the efficiency with which an economy transforms inputs into outputs. Statistics Canada produces summary statistics to capture various aspects of this process.

The least complex of the summary statistics are partial measures of productivity, which consider a single input like labour or capital. Labour productivity is measured as gross domestic product (GDP) per hour worked. Capital productivity is measured as GDP per unit of capital.

More complex measures take into account more than one input simultaneously—for example, labour and capital taken together. These multifactor productivity (MFP) estimates are measured as GDP per unit of a combined bundle of labour and capital.

MFP measures were devised to provide a more comprehensive analysis of the forces that drive growth than simple partial measures of productivity provide. For example, understanding the growth process requires that we understand the sources of labour productivity growth.

Growth in labour productivity is intrinsically of interest because of its close relationship over time with changes in real labour compensation. Of interest are the sources of that growth. Growth in labour productivity may come from applying more capital (machinery and equipment, structures) to the production process or from technological change. To the extent that the growth from these two sources can be decoupled, the impact of policies that affect them differentially can be evaluated. MFP measures are used to do just this.

Productivity is measured either in level or growth terms—as is GDP, but, as with GDP, most attention is focused on productivity growth—and a great deal of attention is devoted to comparisons of productivity growth across countries.

1.2 Why is productivity growth important?[2]

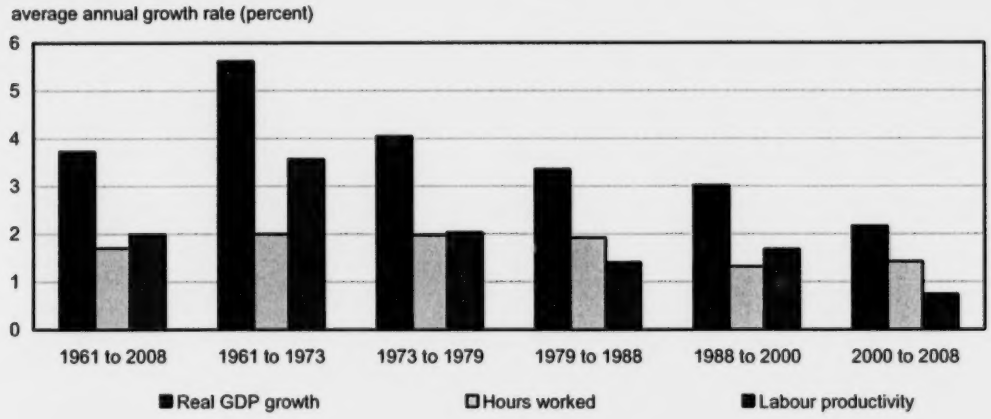
Productivity growth is closely related to growth in our standards of living. Output growth must come from either more inputs or productivity growth. Indeed, this principle underlies the basic

1. Other surveys can be found in Boothe and Roy (2008), Crawford (2002), Dion and Fay (2008).
2. For a more extensive discussion of the issues in this section, see Statistics Canada (2007b).

method of estimating multifactor productivity growth, which is the growth in output in excess of that due to increases in inputs, like labour.

Chart 1 contains the average annual growth of Canada's real gross domestic product (GDP) in the business sector[3] over the 1961-to-2008 period and its various sub-periods, reflecting different economic cycles. Over the period, GDP grew at 3.7% per year on average. Economic growth was quite high during the 1960s and early 1970s, averaging 5.6% annually. Beginning in 1973, economic growth has experienced a steady slowdown, from 4.0% during the 1970s, down to 3.3% in the 1980s, 3.0% in the 1990s and 2.2% after 2000.

Chart 1
Trend in real gross domestic product (GDP), labour productivity and hours at work, business sector



Output growth can be driven by the increase in the resources devoted to production or the efficiency with which these resources are employed. Consider the case of labour input. Output will increase if there are more total hours worked or if workers produce more per hour worked (if labour productivity goes up):

$$GDP = (GDP / Hours) * (Hours) \qquad (1)$$

where *Hours* is the total number of hours worked.

Chart 1 depicts changes in each of these components over time. For the entire 1961 to 2008 period, labour productivity advanced at a 2.0% annual average, accounting for slightly more than half of the increase in GDP growth. The rest was due to hours worked, which increased by 1.7% per year on average.

Over the period 2000-2008, business sector GDP grew by 2.2% per year, less than the 3.0% of the period 1988 to 2000. Labour productivity grew by 0.7% per year versus 1.7% in the previous period. In contrast, hours worked increased by 1.4% between 1988 and 2000, slightly more than the 1.3% between 1979 and 1988. Labour productivity accounted for 34% of GDP growth after 2000, compared to 56% in the previous decade.

3. The business sector is the total economy, excluding non-commercial activities and the owner-occupied proportion of residential housing.

It is often claimed that productivity growth raises living standards. But how does this actually come about? The most direct way in which productivity improvements benefit people is by raising their real incomes. If higher productivity means lower costs and these savings are passed on through lower prices, consumers will be able to purchase goods and services at a lower cost.

The economic theory of production states that, in a competitive economy, the nominal wage that a worker receives will equate to the marginal revenue product of the worker, i.e., the marginal product of the labour multiplied by the price of the output. The change in the marginal product of labour is equal to the change in the nominal compensation of labour deflated, by the output price. In the case of Cobb-Douglas production technology, the marginal product of labour is proportional to the average product per unit of labour or labour productivity. In that special case, real labour compensation, calculated using output price, should rise at the same rate as labour productivity. For more general production technologies, real labour compensation may diverge from labour productivity.

The economic theory of production suggests that the real marginal product of labour should be compared to the labour compensation deflated by output price, not by the consumer price index (CPI) or other final demand prices. As the CPI includes the prices of imports, it will tend to rise more slowly than the price of domestic output when the prices of imports rise less than the price of domestic output.

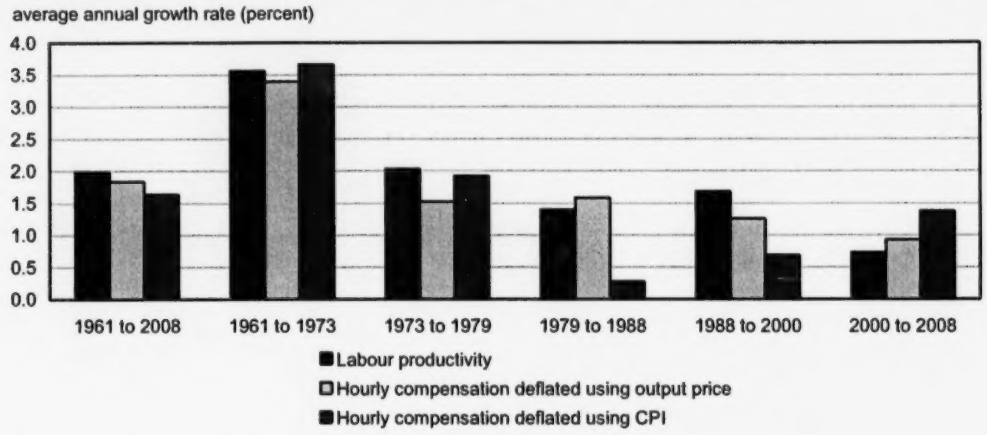
To see the relationship between productivity growth and the rise in remuneration, Chart 2 compares the growth in labour productivity and real hourly labour compensation in the business sector over time. Real hourly labour compensation is derived from the System of National Accounts concept of labour compensation, divided by the gross domestic product implicit price deflator for the business sector. For a comparison, Chart 2 also plots the growth in real labour compensation, calculated using the CPI. While the output price should be used to deflate nominal wages to examine the wage-productivity relationship, it is sometimes argued that the CPI should be used to deflate nominal wages if the objective is to examine the relationship between productivity gains and changes in the standard of living.

Irrespective of the choice of the deflators, the picture that emerges from Chart 2 is one of real hourly labour compensation and labour productivity being closely related in the long run. Over the entire 1961-2008 period, average annual real labour compensation increased by 1.8%, while labour productivity increased by 2.0%. Most of the increase in productivity was passed through to an increase in real hourly labour compensation for the period 1961 to 2008.[4] The slowdown in labour productivity over time translated into slower growth of real hourly labour compensation.

While real hourly compensation and labour productivity rose at about the same rate in the business sector in the long run, there are deviations between the two in the short run. Most notable is the slower growth in the real labour compensation calculated using the output price compared with the growth of labour productivity growth during the deep recessions of the early 1990s. The growth, however, in average annual real hourly labour compensation over the 2000-2008 period (0.9%) tracked labour productivity (0.7%) closely.

4. See also Baldwin, Durand and Hosein (2001) for a study on the extent to which productivity growth at the industry level is passed on to product prices.

Chart 2
Growth in labour productivity and real compensation, business sector



When the CPI is used to deflate labour compensation, the real labour compensation lagged labour productivity growth in the 1980s and 1990s, a period when the falling Canadian dollar raised the price of imported consumer goods.[5]

2 Where does the growth in labour productivity in Canada come from?

Since increases in labour productivity are associated with higher economic growth, standards of living and real incomes, understanding the sources of improvements in labour productivity is important.

Many factors determine the rate of growth in labour productivity: Increases in the amount of machinery and equipment available to workers, a higher proportion of skilled workers, increases in plant scale, changes in organizational structure and improvements in technology.

Using the growth accounting framework that was adopted by the Organisation of Economic Co-operation and Development (OECD) in its recommendations regarding productivity measurement,[6] the Canadian Productivity Accounts can be used to divide labour productivity growth into the part coming from increases in capital intensity, increases in skill levels of workers (referred to here as a change in labour composition)[7] and from all other sources—referred to as multifactor productivity (MFP) growth:

$$\Delta GDP / Hours = (\Delta MFP) + S_K \cdot \Delta(Capital / Hours) + S_I \cdot \Delta LC\,, \qquad (2)$$

where $\Delta GDP / Hours$ is the growth in labour productivity, ΔMFP is the growth in multifactor productivity, S_K is the share of gross domestic product (GDP) accruing to capital,

5. Sharpe, Arsenault and Harrison (2008) provide a number of explanations for this divergence including the declining bargaining power of workers, as well as increases in capital consumption as a result of increased investment in information and communication technologies equipment with a higher depreciation.
6. See OECD (2001).
7. See Gu et al. (2003).

$\Delta(Capital/Hours)$ is the growth in the amount of capital (machinery, buildings and engineering structures) available per hour worked, S_l is the share of GDP accruing to labour, and ΔLC is the growth in the measure of labour skills.[8]

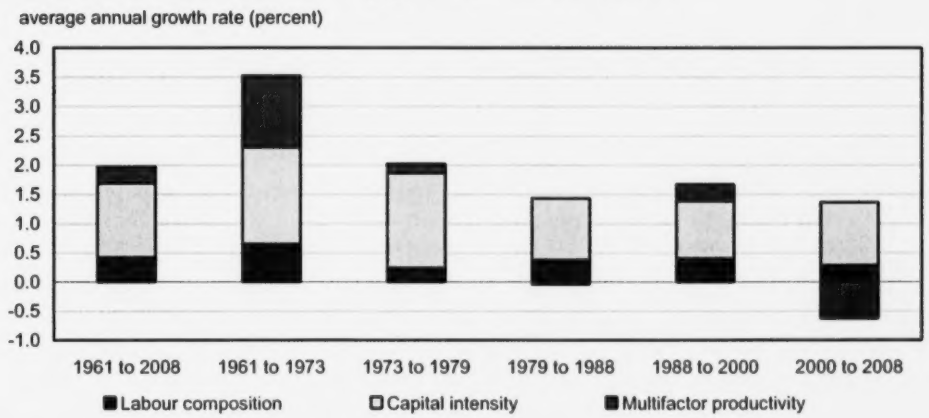
Labour productivity can grow as a result of higher capital intensity per worker. For example, stronger investment in information technology can raise capital intensity. As information technology becomes less expensive, firms substitute information technology for labour and other forms of capital.

Labour productivity can also grow as a result of a higher proportion of skilled workers. Upgrading workers' skills via education or increased experience can increase labour productivity. Canadian companies can upgrade their workers' skills through formal schooling, on-the-job experience or retraining.

MFP captures all other effects. It is the residual factor capturing a host of influences—notably, changes in technology.

This framework is used to decompose the growth in labour productivity into the proportions that come from increases in capital intensity, labour skill levels and MFP (Chart 3). Over the period from 1961 to 2008, increases in capital intensity contributed 1.3% of the 2.0% increase in labour productivity; higher labour skills contributed 0.4 percentage point; and MFP the remaining 0.3 percentage point.

Chart 3
Sources of labour productivity growth, business sector



The deterioration in labour productivity growth from the period between 1961 and 1973 to the period between 1973 and 1979, resulted primarily from the slowdown in MFP growth from 1.2% to 0.2%, and to a lesser extent, a slowdown in the growth in labour composition because of a slower growth in skilled labour (from 0.7% to 0.2%). The contribution made by capital intensity showed no change (1.6% for both periods).

8. For a discussion of the growth accounting framework used to generate this formula, see Baldwin and Gu (2007b).

The slowdown in labour productivity from the 1970s to the 1980s, from 2.0% to 1.4%, was primarily the result of a slowdown in the growth in capital intensity and, to a lesser extent, slower MFP gains.

Over the period from 1988 to 2000, increases in capital intensity contributed 1.0 percentage points of the 1.7% annual increase in labour productivity; higher labour skills, 0.4 percentage points; and MFP, 0.3 percentage points. Since 2000, growth in capital intensity also contributed 1.1 percentage points; labour composition, 0.3 percentage points; but multifactor productivity turned negative.

Increases in labour productivity performance in the 1990s reflected a turnaround in MFP growth. The contributions of capital intensity and labour composition were virtually unchanged since the 1980s. The slowdown in labour productivity after 2000 was almost entirely accounted for by the factors that determine multifactor productivity growth—technology, innovation, firm organization, scale and capacity utilization effects.[9]

The post-2000 slowdown in labour productivity growth has been a focus of several recent studies (Baldwin and Gu, 2007c; Rao and Shape and Smith 2005, OECD, 2006).

3 An examination of weak productivity growth since 2000

Aggregate productivity growth in the business sector can be traced to its origins at the industry level. This section quantifies the contributions of industries to the slowdown in the business sector productivity growth between the period 1988-2000 and 2000-2008.

Industry contributions are derived using a variant of the Domar aggregation technique that expresses aggregate MFP growth as a weighted sum of industry MFP growth using the share of industry value added in aggregate value added as weights.

The methodology for decomposing aggregate labour productivity growth that is used here was developed by Stiroh (2002), who demonstrates that aggregate labour productivity growth can be expressed as a weighted sum of industry labour productivity growth plus a term that reflects the effect of the reallocation of hours worked on aggregate labour productivity growth. The weights for aggregating industry labour productivity growth are given by a two-period average share of industry value added in aggregate value added.

Chart 4 presents the industry contribution to the change in aggregate labour productivity growth, which in the business sector slowed by 0.9 percentage points per year between 1988-to-2000 and 2000-to-2008. The post-2000 slowdown in aggregate business sector labour productivity growth was mostly accounted for by the slower productivity growth of two industries: Mining, Oil and Gas Extraction; and Manufacturing. The Finance, Insurance and Real Estate (FIRE) industries also made a small contribution to the productivity growth slowdown after 2000.

The slower productivity growth in the manufacturing sector accounted for 0.5 percentage points of the post-2000 decline in the aggregate business sector labour productivity growth. The mining, oil and gas extraction industry had a large slowdown in labour productivity growth over time, accounting for almost 0.6 percentage point of the post-2000 decline in aggregate labour

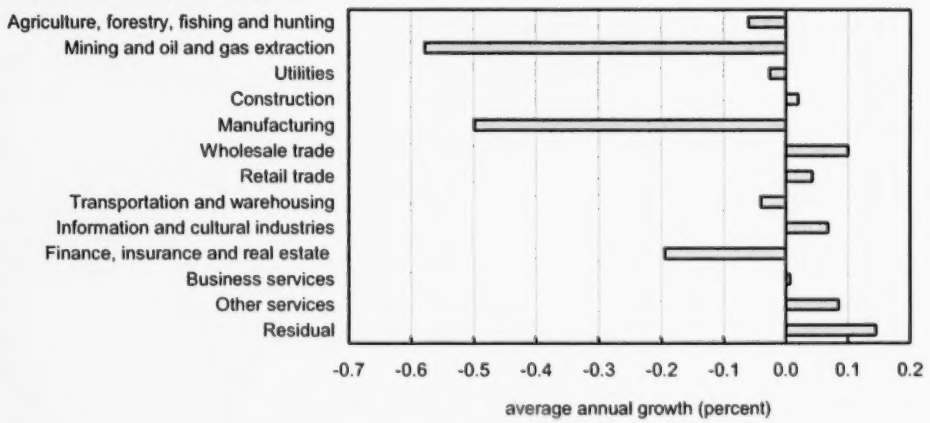
9. See Statistics Canada (2007c).

productivity growth. Finance, Insurance and Real Estate was responsible for 0.2 percentage points of the deceleration in productivity growth.

Chart 5 presents industry contributions to the change in aggregate multifactor productivity growth between the 1988-2000 and 2000-2008 periods. The results for the industry origins of MFP growth deceleration after 2000 echo those for the sources of labour productivity growth deceleration. The decline in the business sector MFP growth after 2000 reflects the declining MFP growth in Mining, Oil and Gas Extraction and Manufacturing industries. The MFP growth decline in Finance, Insurance and Real Estate industries also made a small contribution to the slower MFP growth in the business sector after 2000.

Since 2000, Canadian businesses experienced some major shocks. First, the high technology growth spurt of the late 1990s was reversed after 2000. Second, the Canadian dollar experienced a strong appreciation against the U.S. dollar after 2003. Third, commodity prices increased substantially because of strong global demand for energy and other primary commodities. Those shocks have affected productivity growth in the Canadian manufacturing, and mining, oil and gas extraction industries.

Chart 4
Industry contributions to the change in labour productivity growth from 1988/2000 to 2000/2008



Real GDP growth in manufacturing declined from 3.4% per year in the period 1988-2000 to -0.9% in the period 2000-2008. This reflects a decline in demand for the output of the manufacturing sector after the dot-com bubble burst and the strong appreciation of the Canadian dollar after 2002. Nominal exports of manufacturing goods declined by 1.2% per year over the period 2000 to 2005 (CANSIM table 383-0012). The ratio of exports to gross output declined from an 0.53 in 2000 to 0.47 in 2005 for the Canadian manufacturing sector. As a result of the bursting of the dot-com bubble, demand for information and communication equipment declined after 2000. The electronic product manufacturing industry showed the largest reversal in real GDP, from an 11.2% annual increase in the period 1988 to 2000 to an 5.5% annual decline in the period 2000 to 2008.

Chart 5
Industry contributions to the change in multifactor productivity growth from 1988/2000 to 2000/2008

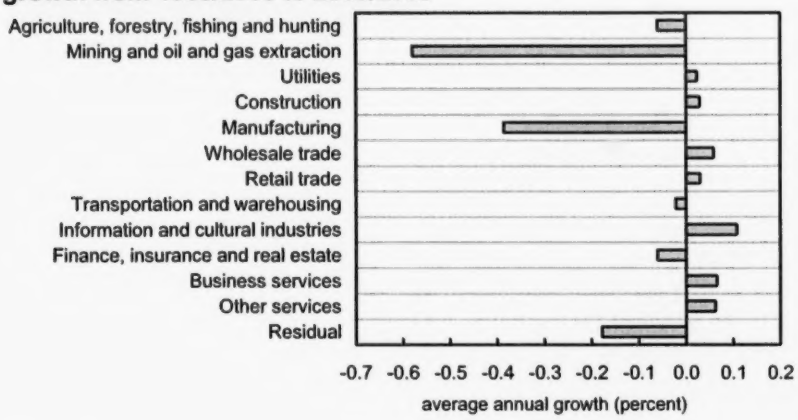
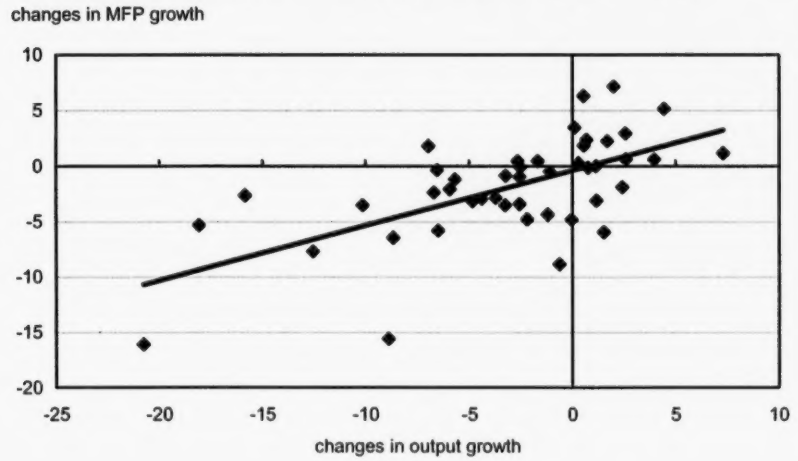


Chart 6
Changes in output growth and multifactor productivity growth from 1988/2000 to 2000/2005, by manufacturing industries



The post-2000 decline in manufacturing output growth is a main factor behind the decline in labour and multifactor productivity growth. As shown in Chart 6, there is a strong and statistically significant association between the changes in output growth and the changes in MFP growth over time across manufacturing industries. There is also a strong and significant association between changes in output growth and changes in labour productivity growth.

There are two reasons for this association. First, it reflects the positive feedback effect between output growth and productivity growth of the sort known as the P. J. Verdoorn (1949) or Nicholas Kaldor (1967) effect. Increased output, associated with an expanding market, will lead

to increased economies of scale, greater product specialization and increased investment in advanced technology, all of which leads to higher productivity growth.[10]

Second, it also reflects the learning-by-exporting effect in the Canadian manufacturing industries that was found by Baldwin and Gu (2003) and Lileeva and Trefler (2007). For the post-2000 period, many exporters experienced a decline in export intensity, partly as a result of the strong appreciation of the Canadian dollar. This was associated with a deterioration in aggregate productivity performance, as both declines in export intensity and exits from export markets were associated with lower plant productivity performance (because of declining plant size and a reversal of the so-called learning-by-exporting effect).

The slowdown in productivity growth after 2000 was widespread across manufacturing industries. Of the 45 manufacturing industries at a North American Industry Classification System (NAICS) 3-digit level of aggregation, 35 industries experienced a decline in labour productivity growth after 2000. The electronic products manufacturing industry made the largest contribution to the slowdown in labour productivity growth in the manufacturing sector between 1988 - 2000 and 2000-2005 periods, accounting for 0.20 percentage points of the 2.4 percentage point slowdown in aggregate manufacturing labour productivity growth. The motor vehicle and pulp and paper industries each contributed 0.08 percentage points to the deceleration in aggregate manufacturing labour productivity growth.

While the weak productivity growth of the manufacturing sector after 2000 was related to the rising Canadian dollar and the burst of the dot-com bubble, the weak productivity growth of the mining sector was related to rising prices of energy and other primary commodities (Cross, 2007, Sharpe et al, 2008). The increase in prices led to lower grade (but more expensive) ore and energy sources being exploited.

It has been hypothesised that strong corporate profits in Canada after 2000 may also have contributed to weak productivity growth. The share of corporate profits in nominal GDP in Canada increased from an average of 8.6% in the period 1988 to 2000, to 12.7% in the period 2000 to 2008.[11]

Strong profits may lead to higher productivity growth through increased investment in physical and intangible capital. On the other hand, strong profits, it is sometimes argued, may reduce incentives to improve production efficiency, as businesses become complacent.

We found no evidence in support of the hypothesis that strong profits in the 2000s had a negative effect on labour productivity growth in Canadian industries. The change in labour productivity growth over the periods 1988-2000 and 2000-2005 is not related to the changes in average capital income shares of nominal GDP over those two periods across Canadian industries in the business sector.

10. See Baldwin, Gaudreault and Harchaoui (2001) for an estimate of the contribution that economies of scale make to productivity estimates.
11. CANSIM table 380-0016.

4 International productivity comparisons

Data that may be suitable for one purpose—that meet acceptable quality standards in one area—may not be for others. Statistics may be developed for one purpose, but users may begin to employ them for other purposes for which they were not designed and for which they may be less than ideal.

The evolution of the Canadian productivity program is a case in point. Statistics Canada's productivity accounts were originally developed to provide information on productivity growth rates in Canada—first with regards to labour productivity and then to multifactor productivity (what academics often refer to as 'total factor productivity'). In a world of increasing globalization, user demands for international comparisons have increased. Providing estimates for international comparisons that meet acceptable quality standards poses particular challenges.

The productivity program at Statistics Canada first focused on providing information products that compare Canada–U.S. productivity growth rates, choosing U.S. estimates that are closest to the Canadian ones. Despite differences between the two countries in sources used, these differences are sufficiently stable over time and generally do not pose a major problem for comparisons of Canada–United States growth rates.

The summary statistics produced by the official productivity programs of the two countries, however, are less than ideal for analysing differences in productivity levels. Recently, Statistics Canada commenced a set of studies that examined alternatives that can be used to estimate the level of relative productivity—both labour and multifactor productivity. Statistics Canada found that despite the relative similarity in the statistical systems of the two countries, improved harmonization of data sources and methodology was required in order to produce better estimates of the relative level of Canada–U.S. productivity.

4.1 Relative Canada/United States productivity growth[12]

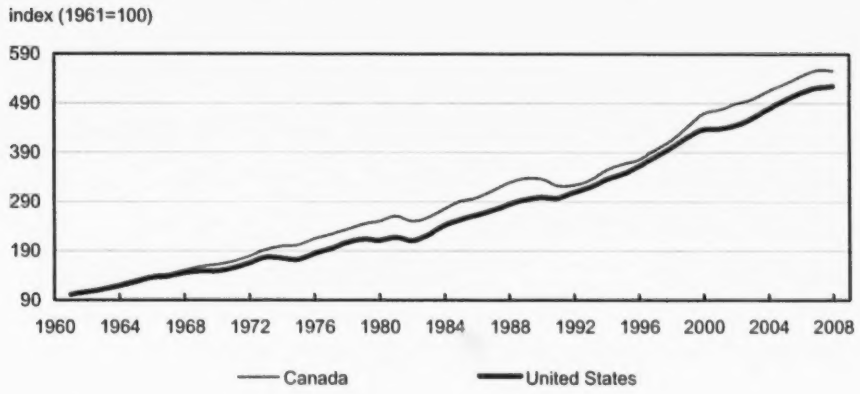
The cumulative growth in business sector gross domestic product (GDP), labour input (measured by hours worked) and labour productivity over the post-1961 period are presented in Charts 7, 8, and 9 respectively—with 1961 indexed to 100 in both countries.

Canadian output growth exceeded that of the United States in the 1970s, kept up with U.S. output growth in the 1980s, experienced a greater slowdown in the early 1990s and then broadly kept pace with that of the United States in the 1990s and 2000s (Chart 7). In contrast, labour input grew at a more rapid pace in Canada than in the United States during most decades, with the largest divergences occurring after 2000 (Chart 8).

Labour productivity grew more quickly in Canada during the earlier period, reaching a zenith around 1985, returning to the same relative level about 1990, remaining unchanged throughout the 1990s, and falling behind since then (see Chart 9). Over the entire time period, the rate of growth in labour productivity is not significantly different from that of the United States, although the most recent decline is noteworthy.

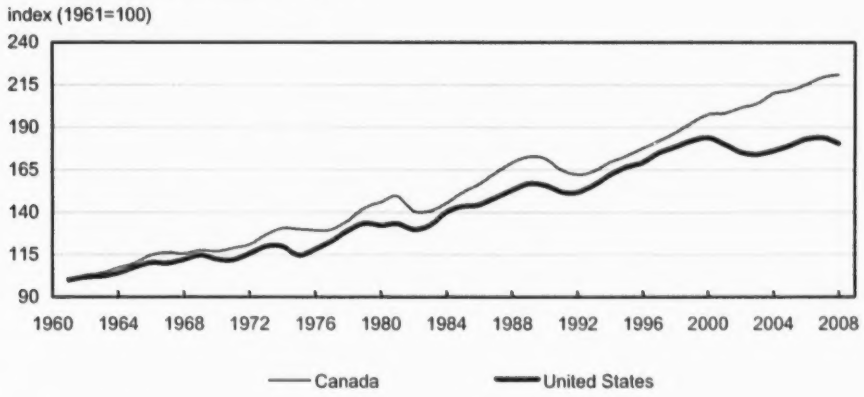
12. General surveys of U.S. productivity growth can be found in Bureau of Labor Statistics 1983, Jorgenson, Ho and Stiroh 2005, and Triplett and Bosworth 2004.

Chart 7
Real gross domestic product trend, business sector



Sources: Statistics Canada; Bureau of Economic Analysis.

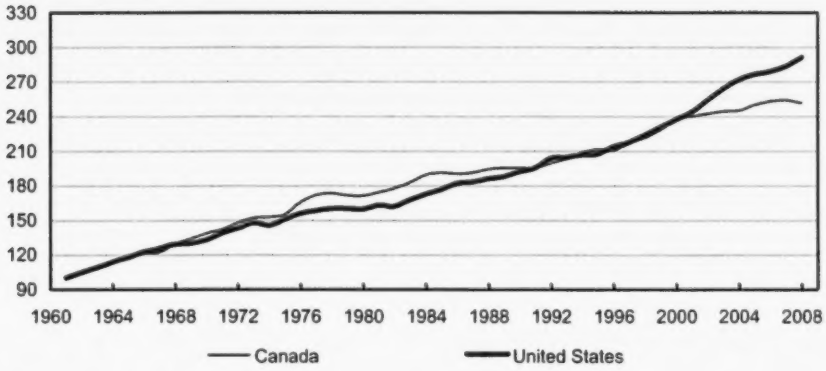
Chart 8
Hours at work, business sector



Sources: Statistics Canada; Bureau of Economic Analysis.

Chart 9
Labour productivity trend, business sector

index (1961=100)



Sources: Statistics Canada; Bureau of Economic Analysis.

Chart 10
Canada-United States difference in labour productivity growth, business sector
(HP filtered with Lambda=100)

percentage points

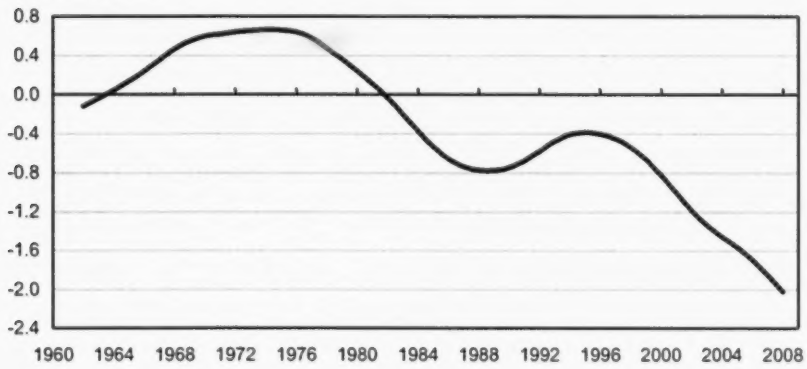


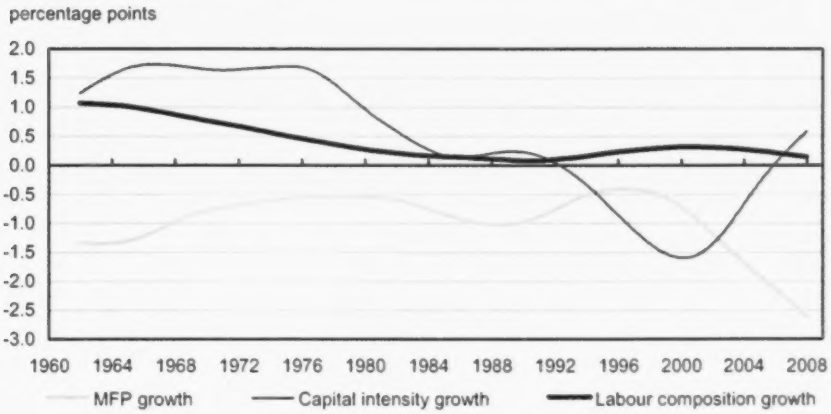
Chart 10 plots Canada's labour productivity growth relative to U.S. labour productivity growth over time. To identify the underlying trend, the Canada/U.S. difference has been smoothed using an HP filter. Labour productivity growth in Canada was higher than in the United States before the mid-1980s. After the 1980s, labour productivity growth was slower in Canada than in the United States. The labour productivity growth difference between the two countries increased over time. The largest difference occurred in the 2000s when Canada's labour productivity growth was less than one-third of that in the United States (0.7% per year for Canada compared to 2.6% per year for the United States over the period 2000-2008).

The differences in labour productivity performance can be decomposed using the growth accounting framework into differences in multifactor productivity (MFP) growth, differences in the growth in capital intensity, and differences in skill upgrading (what the growth accounting framework refers to as changes in the composition of labour).[13] Chart 11 and Table 1 track the relative difference in each of these components.

The following conclusions emerge: The small, persistent difference in Canada–U.S. labour productivity growth over the period from 1961 to 2008 owes much to differences in MFP growth. Over the period from 1961 to 2008, annual labour productivity growth in the Canadian business sector was slightly lower (0.3 percentage points) than in the U.S. business sector. The annual MFP growth in Canada was 0.9 percentage points lower than in the United States.

In contrast, there was no continuous gap in the growth in capital intensity between Canada and the United States over the entire period from 1961 to 1996. Indeed, early in the period, the growth in the contribution of capital deepening to business sector productivity growth was higher in Canada than in the United States. Starting in the late 1970s and early 1980s, however, the difference in capital intensity growth between Canada and the United States fell. The two countries followed much the same path over the late 1980s. A significant gap in the growth in capital intensity opened up in Canada after 1996, which was reversed in recent years.

Chart 11
Canada-United States difference in growth of multifactor productivity (MFP), capital intensity and labour composition, business sector
(HP filtered with Lambda=100)



Sources: Statistics Canada; Bureau of Economic Analysis.

13. For additional details, see Gu et al. 2003.

Table 1
Sources of Canada-United States difference in average annual labour productivity growth

	1961 to 2008	1961 to 1980	1980 to 2000	2000 to 2008
		percent per year		
Canada				
Output per hour worked	2.0	2.9	1.6	0.7
Contribution of capital deepening	1.3	1.7	1.0	1.1
Contribution of labour composition	0.4	0.5	0.4	0.3
Multifactor productivity growth	0.3	0.7	0.3	-0.6
United States				
Output per hour worked	2.3	2.5	2.0	2.6
Contribution of capital deepening	0.8	0.8	0.8	1.0
Contribution of labour composition	0.2	0.1	0.3	0.2
Multifactor productivity growth	1.2	1.6	0.8	1.4
Canada minus United States				
Output per hour worked	-0.3	0.4	-0.4	-1.9
Contribution of capital deepening	0.4	0.8	0.2	0.1
Contribution of labour composition	0.2	0.4	0.1	0.1
Multifactor productivity growth	-0.9	-0.9	-0.6	-2.1

The contribution of labour composition to business sector labour productivity growth was higher in Canada than in the United States over much of the period from 1961 to 2008, although the advantage declined later in the period. Over the period from 1961 to 2008, the shift towards more educated and more experienced workers was more rapid in Canada, raising the labour productivity growth by 0.2 percentage points per year in the Canadian business sector relative to that of the U.S. business sector.

Over the period 2000-2008, labour productivity growth in the Canadian business sector was much lower than that of the U.S. business sector. The Canada-U.S. labour productivity growth gap was 1.9 percentage points per year over the period 2000-2008.

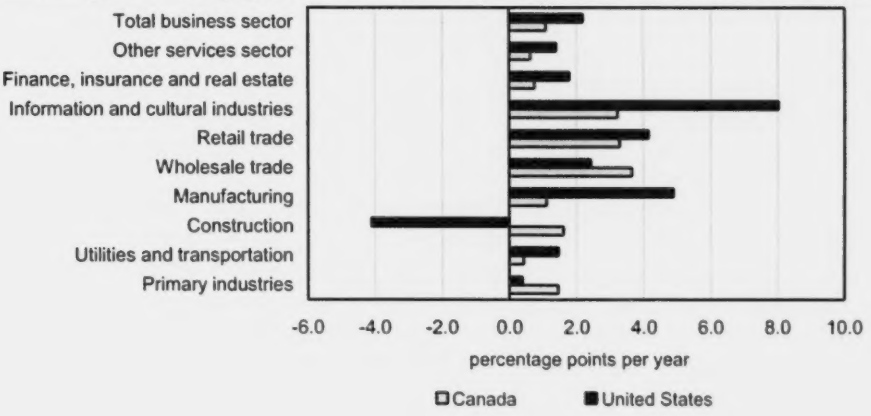
The most important contributor to the Canada-U.S. labour productivity growth gap in the period 2000-2008 was slower MFP growth in Canada. The effect of changes in capital intensity and labour composition was similar between the two countries. The slower relative MFP growth in Canada accounted for all of the slower labour productivity growth in Canada.

Potential explanations have been put forward for the poor labour productivity growth in Canada after 2000 (Rao, Sharpe and Smith, 2005; OECD 2006). All attempt to explain the fall in the multifactor residual. One explanation offered is that profits in Canada have been at record highs, while profits in the United States have been at near-record lows since 2000. With the record high profits, it is argued that businesses in Canada may have become complacent regarding investments, workplace re-organizations and the introduction of new technologies. In contrast, the near-record low profits in the United States may have prompted employers to downsize employment levels to reduce costs. Both these explanations rely on models that assume effort is inversely proportional to organizational slack—and these models do not have widespread support. In addition, an examination of Canadian industries shows no evidence that strong profits are related to relatively lower productivity growth.

Second, it is sometimes argued that the boom in commodity prices that has occurred over the past several years may be a factor in the poor productivity performance in Canada. High commodity prices stimulated the exploration and development of more costly deposits. In effect, lower grade deposits are mined as prices go up and the change in the composition of outputs is thus a detriment to productivity. While no doubt partly true, it is difficult to ascribe the large fall in MFP to this factor alone. The third explanation involves exchange rate appreciation and a loss of export markets for manufacturers. The loss of scale economies may have forced plants back up the cost curve and reduced productivity.

Chart 12 plots labour productivity growth by industries for Canada and the United States.[14] Over the period 2000-2007, Canada had much slower labour productivity growth than the United States in three industries: manufacturing, information and culture, and Fire (Finance, Insurance and Real Estate). These three industries accounted for almost all of the relatively slower labour productivity growth in Canada over the period (Table 2).

Chart 12
Labour productivity growth in Canada and the United States, 2000 to 2007



Interestingly, the mining industries in Canada, with their weak productivity growth, were not responsible for the slower productivity growth in Canada relative to that in the United States.

14. The data for Canada are taken from CANSIM table 383-0021. The data for the United States are obtained from the Bureau of Economic Analysis. The data are not entirely comparable. Labour productivity is defined as 'output per hours worked' for Canada and it is defined as 'output per unit of employment' for the United States. Other differences relate to valuation of output, which is valued at basic prices for Canada and at market prices for the United States. It should also be noted that part of the difference between the two countries may stem from different price deflators being used in the two countries. The United States makes greater use of hedonics to capture increases in quality of product, which can result in higher growth in the volume of goods and services produced.

Table 2
Industry contribution to Canada-U.S. business sector productivity growth difference, 2000-2007

Industries	Canada	United States	Canada minus United States
		percent per year	
Primary Industries	0.2	0.0	0.2
Utilities and Transportation	0.0	0.1	-0.1
Construction	0.1	-0.3	0.4
Manufacturing	0.2	0.8	-0.6
Wholesale Trade	0.2	0.2	0.1
Retail Trade	0.2	0.4	-0.1
Information and Cultural Industries	0.1	0.5	-0.4
Finance, Insurance and Real Estate	0.1	0.3	-0.2
Other Services Sector	0.1	0.3	-0.2
Total Business Sector	1.1	2.2	-1.1

4.2 Relative Canada/United States productivity levels

Recent studies at Statistics Canada address the manner in which comparable data can be produced to examine the relative labour and multifactor productivity levels between Canada and the United States.[15]

The relative labour productivity level measures the relative efficiency with which the two economies transform labour into output, but the relative level of labour productivity captures only one dimension of the relative efficiency of the production system. The overall efficiency of the production system also depends on the efficiency with which capital is used in the two countries. The relative MFP level compares the relative output differences across two countries, not only to labour input differences, but also to capital input differences, and thus provides a more complete measure of overall efficiency. The relative multifactor productivity level captures the difference in the overall efficiency of an economy that arises from the use of superior production techniques, technology, firm organization, firm scale and labour quality.

Studies at Statistics Canada identified several problems with many previous attempts to compare Canada–United States levels of labour productivity.[16] First, these studies sometimes did not use measures of GDP that were comparable. GDP can be measured at market prices, at basic prices and at factor cost: The level of GDP produced by these estimates can vary by up to 16%. Second, comparisons of the levels of GDP across countries must take into account differences in price levels if relative values of nominal output are to be transformed into relative levels of real output. For this purpose, purchasing power parities (PPPs) are necessary, but the existing PPPs are not sufficiently precise to produce estimates of relative levels of output without quite large confidence intervals around them. Finally, and most important, obtaining accurate estimates of relative labour input poses particular challenges. Differences exist in the way that labour input is calculated in the 'official' productivity programs of both countries that have led to a substantial downward bias in the relative Canadian level of labour productivity when it is derived from the official sources of labour productivity from each country. The estimate of total hours worked comes from the number of jobs multiplied by hours worked per job. The estimate of hours worked per job is derived from a labour force (household) survey, and is generally higher than

15. Baldwin et al. (2005), Maynard (2007c), Baldwin, Gu and Yan, (2008).
16. See Baldwin et al. (2005) and Maynard (2007c).

the estimate derived from an employer survey. The Canadian productivity program relies on the former, while the U.S. productivity program relies on the latter. When data sources and methodology in Canada and the United States are harmonized, the relative labour intensity in Canada decreases by between 5% and 10% relative to the estimate derived from each country's official estimates used in the productivity growth programs.

If we wish to measure relative MFP level differences and understand the factors that drive differences in labour productivity between Canada and the United States, additional work is required to derive estimates of inputs other than labour. The most important for transforming relative labour productivity into relative multifactor productivity (MPF) is an estimate of relative capital intensity. Once again, data sources and methodology in Canada and the United States must be harmonized. Perhaps the most important choice here is that of depreciation estimates, because capital is estimated as the sum of past investments, less the depreciation that has taken place.[17]

Canada and the United States do not use exactly the same depreciation estimates, although they both employ used asset prices to estimate the rate at which investments in new assets decline in value (i.e., depreciate) over time. Canada has a comprehensive set of price data that is associated with its investment survey. The United States makes use of a myriad of sources (especially trade publications) to estimate its depreciation rates. The resulting estimates for Canada and the United States differ slightly for machinery and equipment and more for buildings and engineering structures.[18]

There are differences between Canada and the United States in the importance of different types of physical capital. Despite the attention that is paid to machinery and equipment, it accounts for no more than 25% of total capital in Canada in 1999. In contrast, buildings account for over 55%.

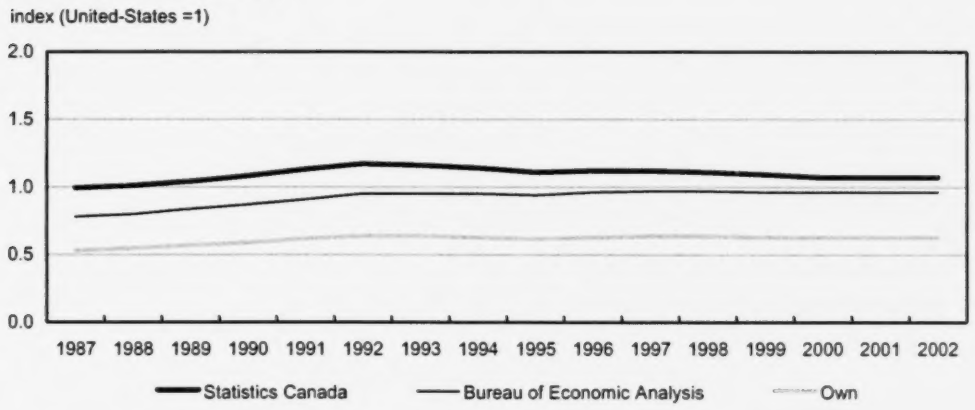
Large amounts of capital are also devoted to engineering construction in Canada. In fact, at 20%, the share of engineering construction is almost as large as that of machinery and equipment. These assets underpin utilities, pipelines, railways, airports, communications and the oil and gas sector.

Capital stocks in both countries are calculated by accumulating investments over time using the perpetual inventory method, which requires estimates of service lives and depreciation rates. The two countries, however, do not use exactly the same services lives and depreciation rates. Depreciation rates in the United States that are used by the Bureau of Economic Analysis (BEA) are sometimes lower than those used in the Canadian productivity program, particularly in engineering structures and building structures. Therefore, using estimates of capital stock that are employed in the two official MFP programs may bias the estimate of the relative level of MFP. Previous comparisons of capital intensity between Canada and the United States using unadjusted depreciation rates may be inaccurate because they reflect different methodologies and data sources.

17. Ongoing work is being undertaken to put the estimates of investment on the same basis. Canada places more of the total expenditures made on machinery and equipment per year into the investment, as opposed to the repairs category, than does the United States. Future work on MFP comparisons will be directed at this area.
18. Canada also has estimates of expected length of life that it uses to confirm the estimates it derives from used asset price data. See Statistics Canada (2007b).

The effects of using different depreciation rates on relative capital stock/GDP ratios are shown in Chart 13, which plots the ratio of capital to gross domestic product (GDP) using both the depreciation rate of Statistics Canada and that of the Bureau of Economic Analysis, based on each country's respective depreciation rates. The line labelled 'Own' depicts the course of the total capital-to-GDP ratio if we employ the productivity estimate from the Canadian productivity program and the BEA productivity program. Chart 13 also contains the capital–output ratios using common depreciation rates (either Canadian or U.S.) to produce estimates of capital stocks for both countries. Using common rates raises Canada's relative capital intensity. We first apply BEA depreciation rates to the Canadian stock and compare capital intensities between the two countries. Based on common BEA depreciation rates, Canada's relative capital intensity becomes higher than that based on 'own' depreciation rates. To undertake a sensitivity analysis we also apply Statistics Canada's depreciation rates, used in its productivity program, to BEA capital stocks. Interestingly, Canada's relative capital intensity rises further when Statistics Canada's depreciation rates are used.[19] Thus, the magnitude of the difference between Canada's capital intensity and U.S. capital intensity is also sensitive to the choice between BEA and Statistics Canada depreciation rates, although in the latter part of the 1990s, there is not much difference between the two curves, and the difference is not statistically significant.

Chart 13
Canada's total capital stock intensity relative to the United States, business sector (in 1997 dollars)



Sources: Statistics Canada; Bureau of Economic Analysis.

An examination of capital-to-GDP ratios by asset class, however, reveals substantial differences. Canada's engineering capital-to-GDP ratio is higher than that of the United States and has been growing relatively larger over time.[20] Building capital intensity was slightly higher in the early 1990s but has fallen behind recently. Machinery and equipment capital intensity was about the same in the early 1990s, but it too has fallen slightly behind.

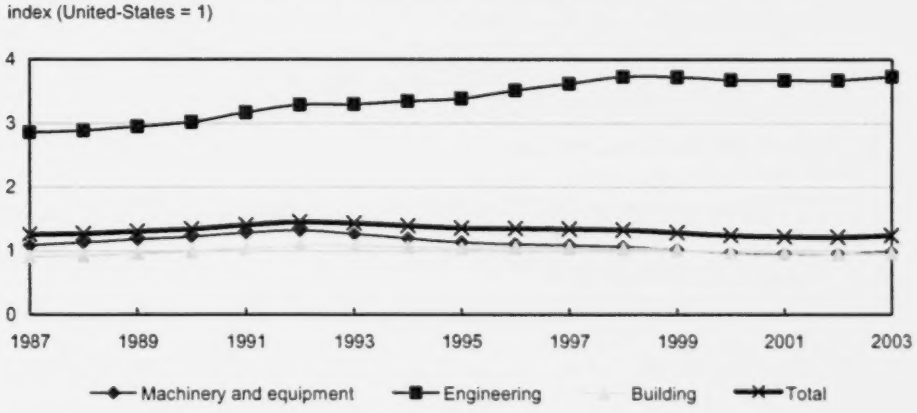
The evidence on relative capital intensity can be used to generate a measure of the relative value of capital services and then, combined with the level of relative labour productivity, to generate a measure of the relative MFP in Canada compared with the United States. Table 3 presents the

19. These results apply to all asset types in both 1997 and current dollars.
20. This trend has been occurring for a long time. Baldwin and Gorecki (1986) report that in the manufacturing sector, the Canada/U.S. ratio of machinery and equipment was relatively stable between 1961 and 1979, but structures and engineering increased in relative terms.

relative Canada/U.S. levels of labour productivity, MFP and capital intensity for the benchmark year 1999. The aggregate level of labour productivity in Canada was 84.2% of the U.S. level. The lower labour productivity level in Canada was due to the lower MFP level. Capital intensity (measured by capital services per hour worked) is higher in Canada than in the United States, while the MFP level in the Canadian business sector was 80.3% that of the United States in 1999. The higher capital intensity in Canada was due to higher capital intensity in engineering structures in 1999. Canada's capital intensity in machinery and equipment was lower than in the United States.

The results from the decomposition of relative labour productivity levels to contributions from relative MFP levels and relative capital intensity are based on the assumption that the rate of returns to investment are the same for structures and machinery and equipment. If the rate of the return to investment in machinery and equipment (such as information and communications equipment) is higher than the rate of return to investment in structures, the relatively low labour productivity level can be accounted for by Canada's lower investment in machinery and equipment (Baldwin, Gu and Yan, 2008).

Chart 14
Canada's total capital stock intensity relative to the United States, business sector, using Statistics Canada's depreciation rates (in 1997 dollars)



Sources: Statistics Canada; Bureau of Economic Analysis.

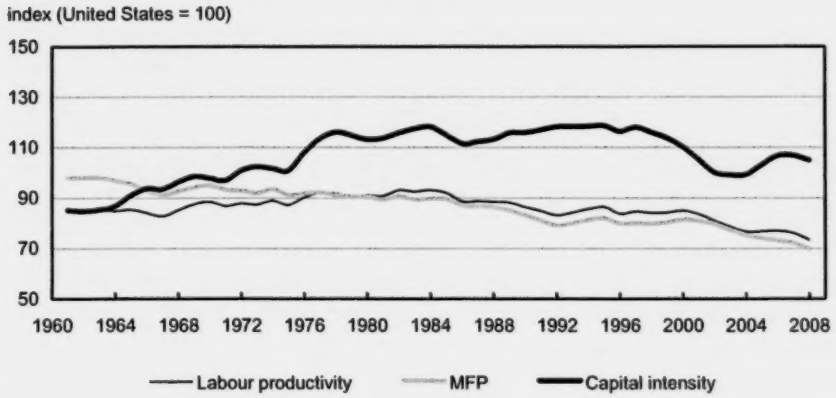
Table 3
Relative Canada–United States productivity levels in the business sector

Business sector	1999
	percent
Labour productivity levels	84.2
Multifactor productivity levels	80.3
Capital intensity	113.6

Source: Statistics Canada; Bureau of Economic Analysis.

The relative Canada/U.S. levels of productivity and capital intensity in 1999 can be combined with the relative Canada/U.S. growth rates to generate a long-term comparison of Canada/U.S. levels of productivity and capital intensity.[21] Chart 15 plots the relative Canada/U.S. labour productivity levels in the business sector over the period 1961 to 2008.

Chart 15
Canada-U.S. relative levels of labour productivity, multifactor productivity and capital intensity in the business sector



Canada's labour productivity level in the business sector has been lower than that of the United States since 1961. The difference was relatively small in the mid-1980s when Canada's labour productivity was 10% below the U.S. level. After the mid-1980s, Canada's labour productivity declined. By 2008, Canada's labour productivity was only three-quarters of the U.S. level. Much of labour productivity level differences since 1961 reflect a lower MFP level in Canada, whereas capital intensity was higher than in the United States.

4.3 Contribution of Canada/U.S. productivity level difference to Canada/U.S. GDP per capita difference

The debate about the productivity gap between Canada and the United States often revolves around its contribution to a GDP per capita gap. GDP per capita differences between Canada and the United States can be examined using the following identity:

$$GDP / CAP = (GDP / HRS) * (HRS / EMP) * (EMP / CAP) . \quad (3)$$

This identity decomposes relative GDP per capita (*GDPCAP*) into the product of relative labour productivity (*GDP / HRS*), relative effort (the hours worked per job [or per employee]), and the relative per capita employment rate (the ratio of the number of employees [or jobs] to the total population). The equation can be rewritten in the following manner:

$$GDPCAP = PROD * EFFORT * EMPRATE . \quad (4)$$

21. The relative MFP level in Table 3 includes the relative labour composition differences between Canada and the United States since labour input in the table is measured by hours worked and does not take into account the effect of changes in labour composition. To be consistent with the level comparisons, we have added the labour composition effect to the MFP growth in Chart 15 and use these gross MFP growth differences to project the MFP levels differences over time.

The amount available for consumption per person in a country *(GDPCAP)* will be higher when productivity (*PROD*) is higher, when employees work longer hours (referred to here as *EFFORT*), and when a larger proportion of the population is employed (*EMPRATE*). The variables *EFFORT* and *EMPRATE* can also be grouped together in a variable that captures the number of hours worked per capita (sometimes referred to as labour utilization).

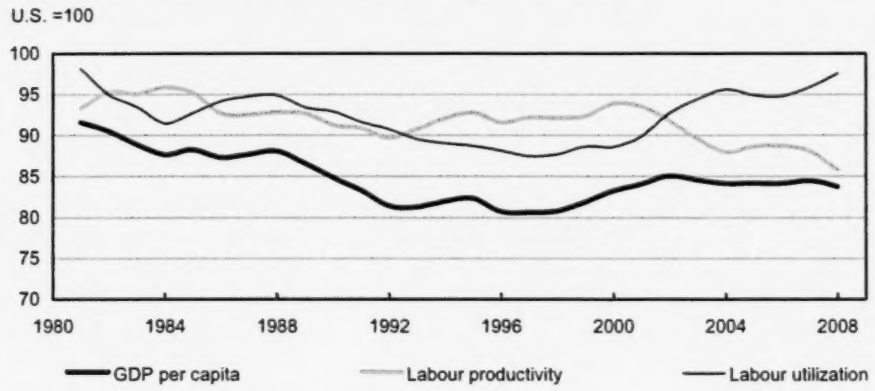
The decomposition is carried out at the total economy level. The labour productivity estimates refer to the total economy. Statistics Canada normally only produces productivity growth estimates for the business sector because the estimation procedure followed by the National Accounts in most major nations for the non-business sector (the non-market sector) essentially assumes that productivity growth in that sector is zero. The relative labour productivity level in the total economy is the weighted average of the relative labour productivity levels of the business and non-business sectors. The relative labour productivity levels of Canada, compared to the United States in the non-business sector, is essentially assumed to be one as a result of the procedure used for estimating relative prices for the output of the non-business sector.[22] When comparing the results of relative productivity levels for the total economy with the results for the business sector, we note that GDP used for measuring labour productivity in the total economy in Chart 16 is valued at market prices, while GDP used for measuring labour productivity in the business sector is valued at basic prices.

In 2008, the level of GDP per capita in Canada was 84% of GDP per capita in the United States (Chart 16). In other words, the Canada/U.S. output gap favoured the United States by 16%, in terms of GDP per capita. The relatively lower level of Canadian labour productivity accounted for 14 percentage points of the output gap. Less hours worked per capita in Canada accounted for the remaining 2 percentage points of the output gap with the United States.

GDP per capita growth in Canada has been virtually the same compared to the United States after 2000. This is the result of the increase in Canada's labour utilization (hours worked per capita), which is offset by the decrease in Canada's relative labour productivity.

22. Note that cross-country comparisons for the total economy will therefore be affected by the relative size of the non-business sector in each country.

Chart 16
Canada–United States relative gross domestic product per capita, labour productivity and work intensity in the total economy



Sources: Statistics Canada; Bureau of Economic Analysis.

5 Putting productivity in perspective[23]

Evaluations of an economy's productivity performance are made using a measure of real GDP, with the volume or constant dollar indices being calculated from the prices of domestic goods and services produced.

This measure does not account for who receives the income produced in Canada (domestic or foreign residents), or how relative price shifts of exports versus imports (the terms of trade) affect the volume of goods and services that can be purchased with that income.

Modifications can be made to traditional estimates of GDP to account for these factors, and the performance of the Canadian economy can be examined using the resulting alternative measure of real GNI.

Real GNI is a measure of the purchasing power of income that accrues to Canadians. Differences arise between real GDP and real GNI for two reasons. First, in nominal terms there is a difference between the level of income earned in Canada (nominal GDP) and the income that accrues to Canadians (nominal GNI) because Canadians invest and work abroad, and foreigners invest and work in Canada. Some of the income earned outside Canada accrues to Canadians and some of the income earned in Canada accrues to foreigners. Changing investment levels, rates of return and work patterns mean that the level difference between the two is not constant over time.

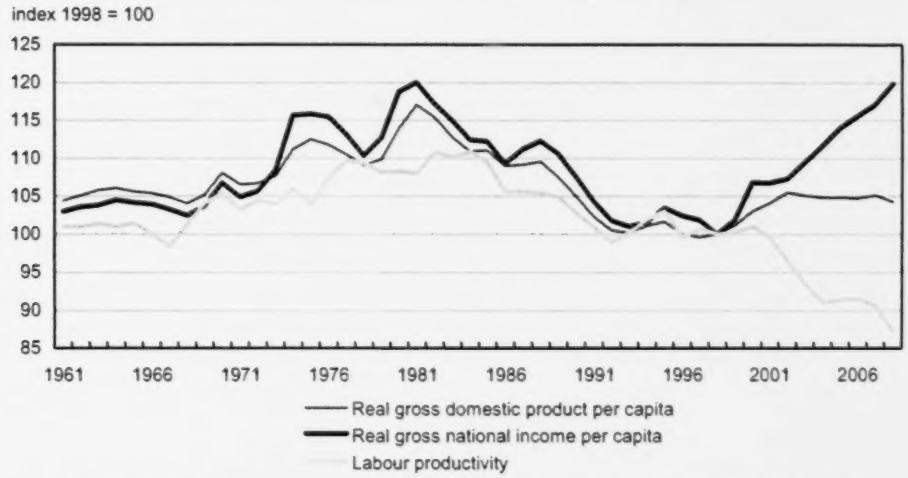
Second, real GNI incorporates changes in purchasing power that real GDP does not. Real GDP is created by deflating nominal GDP by a price index of domestic production. Real GNI makes use of the prices of domestic expenditures. When price movements are removed from nominal GDP, terms-of-trade changes are treated as price effects that do not influence volumes. This is

23. For further discussion of this issue, see Macdonald (2007).

appropriate for measuring changes associated with an economy's productive abilities. Real GNI treats terms-of-trade changes as a volume phenomena, meaning that changes in the terms of trade affect items like consumption or investment. This is appropriate for examining movements in domestic absorption.

For purposes of comparison, measures of real GDP per capita, real GNI per capita and labour productivity in Canada relative to the United States are presented in Chart 17. In real terms, the Canadian economy outpaced the U.S. economy between 1961 and 1980. This period of relative increase in Canada correlates with the oil shocks of the 1970s that favoured Canada. Following the second oil shock, from 1981 to the late 1990s, the U.S. outpaced Canada in real terms, leaving Canada in about the same position it was in the early 1960s. The results are consistent regardless of the measure employed.

Chart 17
Economic performance of Canada relative to the United States[1]



1. Real gross domestic product and real net national income per capita are for the economy as a whole while labour productivity is for the business sector.
Sources: Statistics Canada; Bureau of Economic Analysis.

In the period before 2000, all the measures point to the same story. But this changes after 2000 when the measures of relative performance diverge quite markedly. After the late 1990s, labour productivity in Canada did not keep pace with labour productivity in the United States. Relative real GDP was essentially unchanged although there are some relative gains for Canada around the 2002 U.S. recession. The difference between real GDP and productivity growth after 2000 occurred because the Canadian labour market was much more buoyant that the U.S. labour market—despite the fact that GDP grew at about the same pace. But with the commodity boom after 2000, the price of exports rose dramatically relative to imports. As a result, relative real GNI rose in a similar manner to that seen during the earlier oil shock in the 1970s, as rising commodity prices increased Canada's terms of trade and decreased America's.

As a result, comparisons of the relative performance of the two countries hinge on whether or not international income flows and terms-of-trade shifts are included in the analysis. Between 2002 and 2008, real GDP per capita in the United States rose 10%, while in Canada real GDP per capita increased by 8%. Once changes in international income flows and purchasing power are accounted for, real GDI in the United States rose 7% between 2002 and 2008. In Canada, real GNI per capita increased 19% over the same period, more than double the U.S. rate.

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